Claim(s)

- 1. A method of instrumenting a byte code computer program, comprising:
 - (a) examining the byte code;
 - (b) selecting portions of the byte code for instrumentation; and
 - (c) instrumenting the portions to provide instrumented byte code.
- 2. A method according to claim 1, wherein selecting the portions includes choosing portions of the byte code corresponding to at least one of: method entry, method exit, a throw, a method call, and a new line number.
- 3. A method according to claim 2, wherein instrumenting a portion of the byte code corresponding to a method call includes instrumenting a local line number of source code corresponding to the byte code being instrumented.
- 4. A method, according to claim 1, wherein instrumenting the portions includes adding calls to instrumentation runtime functions that pass parameters indicative of the portions being instrumented.
- 5. A method, according to claim 4, wherein at least one of the parameters that is passed includes a line number of the source code corresponding to the portion being instrumented.
- 6. A method, according to claim 4, wherein at least one of the parameters that is passed includes a thispointer for the method corresponding to the portion being instrumented.
- 7. A method, according to claim 4, wherein at least one of the parameters that is passed corresponds to at least one method parameter provided to a method containing byte code that is being instrumented.

- 8. A method, according to claim 7, wherein data indicative of the at least one method parameter is passed in a message buffer from an instrumentation runtime function to at least one viewer routine that displays the data to a user.
- 9. A method, according to claim 8, wherein the message buffer includes scalar data, array data, and object data.
- 10. A method, according to claim 9, further comprising:
 - (d) placing an object header in the message buffer; and
 - (e) placing an array header in the message buffer.
- 11. A method, according to claim 10, further comprising:
 - (f) limiting the message buffer to a predetermined size.
- 12. A method, according to claim 4, wherein data indicative of the parameters are stored in a message buffer.
- 13. A method, according to claim 12, wherein data from the message buffer is passed to at least one viewer routine that displays the data to a user.
- 14. A method, according to claim 1, further comprising:
 - (d) instrumenting an end of a method to provide instrumentation for handling an abort.
- 15. A method according to claim 1, further comprising:
 - (d) instrumenting a call to a native function by adding a byte code wrapper to the native function and then instrumenting the wrapper.
- 16. A method, according to claim 15, wherein the wrapper includes byte code corresponding to method entry and exit portions.

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- 17. A method, according to claim 1, further comprising:
 - (d) instrumenting a call to a native function by providing an native assembly language thunk that captures data passed to and from the native function.
- 18. A method, according to claim 17, further comprising:
 - (e) hooking the assembly language thunk between the virtual machine and the call to the native function.
- 19. A method, according to claim 18, wherein hooking the assembly language thunk includes intercepting a call that provides an address for a procedure.
- 20. A method, according to claim 1, further comprising:
 - (d) providing a routine to pass data via a message stream.
- 21. A method, according to claim 20, further comprising:
 - (e) providing a data storage to store data provided via the message stream.
- 22. A method, according to claim 20, further comprising:
 - (e) providing a viewer to allow viewing at least a subset of data from the message stream as the data is being generated.
- 23. A method of instrumenting a computer program, comprising:
 - (a) examining an initial byte code representation of the program;
 - (b) creating a program counter mapping table corresponding to the byte code representation;
 - (c) selecting portions of the byte code representation for instrumentation using the program counter mapping table;
 - (d) instrumenting the portions by adding calls to instrumentation runtime functions at at least some of the portions; and
 - (e) modifying the program counter mapping table according to modifications to the byte code.

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- 24. A method according to claim 23, wherein selecting the portions includes choosing portions of the initial intermediate representation corresponding to at least one of: method entry, method exit, a throw, a method call, and a new line number.
- 25. A method, according to claim 23, wherein instrumenting the portions includes adding calls to instrumentation runtime functions that pass parameters indicative of the portions being instrumented.
- 26. A method according to claim 23, further comprising:
 - (f) instrumenting a call to a native function by adding a byte code wrapper to the native function and then instrumenting the wrapper.
- 27. A method, according to claim 26, wherein the wrapper includes byte code instrumentation corresponding to method entry and exit portions.
- 28. A method, according to claim 23, further comprising:
 - (f) instrumenting a call to a native function by providing an native assembly language thunk that captures data passed to and from the native function.
- 29. A method, according to claim 28, further comprising:
 - (g) hooking the assembly language thunk between the virtual machine and the call to the native function.
- 30. A method, according to claim 29, wherein hooking the assembly language thunk includes intercepting a call that provides an address for a procedure.
- 31. A method, according to claim 23, further comprising:
 - (g) following examining an initial byte code representation of the program, registering each of the methods and corresponding line numbers thereof.

- 32. A method, according to claim 31, wherein registering each of the methods and corresponding line numbers thereof facilitates determining the source code being executed during run time debugging.
- 33. A method of uniquely identifying an object in an object oriented programming language, comprising:
 - (a) obtaining a unique identifier corresponding to the object;
 - (b) creating a data structure having a least a first and a second storage location;
 - (c) storing an identifier for the object in the first storage location; and
 - (d) storing the unique identifier in the second storage location.
- 34. A method, according to claim 33, wherein obtaining the unique identifier includes generating a hash code.

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